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Firm Dynamics: Variation in Profitability Across Canadian Firms of Different Sizes, 2000 to 2009

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Statistics Canada
Economic Analysis Division

Firm Dynamics: Variation in Profitability Across Canadian Firms of Different Sizes, 2000 to 2009

Amélie Lafrance

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Symbols

The following standard symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

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Abstract

Are small firms more profitable than large firms? This paper uses a longitudinal firm-level dataset to explore the financial performance of firms across size classes, and across industries and provinces during the 2000-to-2009 period. It also examines the volatility of profitability across firm size classes. The results show that the relationship between firm size and profitability follows an inverted u-shaped curve—profitability rises up to a relatively small firm size class and falls after that threshold has been reached. This relationship prevails across most industries and provinces and over most of the post-2000 period. Furthermore, on an intra-group basis, smaller firms tend to have much more variability in profit rates.

More studies related to industrial dynamics are available in Update on Economic analysis.

Executive summary

Small businesses continue to attract the attention of policy-makers, small business advocates, and the research community. The job growth, output growth and contribution to the economy of this group of firms are often compared with those of larger businesses. Missing from the debate in Canada has been the relationship between firm size and financial performance. The United States has an extensive literature on this subject, but little is known about whether the size of a business is positively or negatively related to profitability in Canada. As well, information about financial performance by firm size across industries and regions is lacking.

Theoretically, if economies of scale exist, so should a connection between firm size and profitability. As firms increase their workforce and reduce their operating costs, their profits are expected to follow, albeit to a certain threshold—the minimum efficient sized firm. Of course, a number of factors must be taken into account, including industry-specific effects, market size and regulations to account for industry differences in the relative performance of small and large firms. As a result, the evidence on the relationship between firm size and financial performance is mixed, with few agreeing that a relationship even exists. To a great extent, these differences arise from the use of different databases that are often less than representative of the universe of firms.

With information from a longitudinal dataset on the entire Canadian corporate universe, this study examines profitability rates across firm size classes, industries and regions over the 2000-to-2009 period. It may be that smaller firms have higher profit rates than larger firms, but their profits may be more variable on an intra-group basis and over time. Therefore, the volatility of profitability across firm size classes is also examined.

During the period, the relationship between firm size and profitability, as measured by the rate of return on assets, followed an inverted u-shaped curve. That is, for each year, the return on assets increased up to a relatively small firm size class, and fell at larger size classes. This pattern is consistent with other studies showing diminishing returns to firm size in terms of profitability. This relationship between firm size and profitability also held across most industries and provinces.

Intra-group variation in profitability in each year was inversely related to firm size, as measured by the coefficient of variation—smaller firms tended to have much more variability in profit rates. These results provide evidence that as small firms grow to become middle-sized firms, their financial performance becomes more homogeneous. Growth beyond the middle-size leads to greater intra-group variability, but it is still well below that of the smallest firms.

The intertemporal variability of profit rates of individual continuing firms, as measured by the standard deviation of rates of return, over the post-2000 period followed a u-shaped curve. As firms grew beyond the smaller size classes, their intertemporal variability decreased in the middle size class but then increased in the largest groups.

1 Introduction

Small businesses continue to attract the attention of policy-makers, small business advocates, and the research community. These firms are often compared with larger businesses in terms of job growth, output growth, and their contribution to the economy.

Missing from this debate has been the relationship between firm size and financial performance in Canada. An extensive literature on this subject exists in the United States, but little is known about whether firm size is positively or negatively related to profitability in Canada. Information is also lacking on financial performance across industries and regions. Thus, an examination of profitability of firms of different sizes helps to fill an information gap.

Theoretically, if economies of scale exist and prices are set by the largest firms, so should a connection between firm size and profitability. As firms increase their workforce and reduce their operating costs, their profits are expected to rise, albeit to a certain threshold—often called the minimum efficient sized firm. Of course, a variety of factors should be taken into account, including industry-specific effects, market size and regulations, to account for industry differences in the relative performance of small and large firms. Consequently, the evidence on the relationship between firm size and financial performance is mixed, with few agreeing that a relationship even exists. To a great extent, these differences arise from the use of different databases that are often less than representative of the universe of firms.

Based on data derived from Fortune 500 companies or the Internal Revenue Service Statistics of Income, many early studies found no relationship (Amato and Wilder, 1985) or a negative relationship (Osborn, 1950; Stekler, 1964; Samuels and Smyth, 1968) between firm size and profit rates in the United States. However, few firms in these studies were actually "small," because, almost by definition, the databases consisted of large firms. Moreover, the tendency has been to focus on the manufacturing sector and/or a single year. Studies of cross-industry differences have found that size can potentially influence profitability in some industries (Marcus, 1969; Ballantine et al., 1993). Multi-year studies found that results differ across various samples (Osborn, 1950; Samuels and Smyth, 1968; Schmalensee, 1989; Ballantine et al., 1993), because macroeconomic effects on firms of different sizes may differ over time.

Some of the research on the relationship between profitability and firm size has factored in risk and uncertainty. Risk and returns tend to be positively correlated, and higher risk tends to be associated with small firms (Ballantine et al. 1993). Thus, smaller firms may have higher profit rates than do their larger counterparts, but their profits may be more variable on an intra-group basis and over time.

With information from Statistics Canada's T2-LEAP database that covers the entire corporate universe, this paper analyzes profitability rates by firm size class, industry and province during the 2000-to-2009 period.[1] It begins with a description of measures of profitability that are associated with the data source used, as well as a description of the data source. Next, it examines profitability rates across industries and provinces and financial performance across firm size classes. Finally, the volatility of profitability is examined across firm size classes.

1. The T2-LEAP database links the Longitudinal Employment Analysis Program (LEAP), a longitudinal file on firm employment, to data derived from the corporate tax file of firms. The Appendix contains a discussion of the coverage and quality of the file.

2 Profitability measures and data source

The data are from Statistics Canada's T2-LEAP longitudinal firm-level database, covering the 2000-to-2009 period. The dataset pertains to incorporated firms in Canada that hire employees. It contains detailed information from firm financial statements, including balance sheets and income statements, and a measure of employment that is used to calculate firm size.

Industries are identified based on the 2-digit North American Industry Classification System (NAICS) level of aggregation. Firms in industries that are public or are directly supported by public expenditures and/or activities that do not have a profit motive are excluded. These industries include Monetary Authorities (NAICS 5211), Religious Organizations (NAICS 813), Private Households (NAICS 8141), and Public Administration (NAICS 91). We also excluded from the analysis, some firms in Education (NAICS 6111, 6112 and 6113) and in Health Care and Social Assistance (NAICS 6211, 6214, 6219, and 6221 to 6224).

Firm size is measured by employment, rather than assets, which was often used in earlier studies of profitability. Employment is a LEAP variable. It is not a count of individuals working at a firm, but a derived measure, based on total payroll in a firm divided by the average hourly earnings in the firm's industry according to the Survey of Payroll, Employment and Hours. The Appendix contains a more detailed description of the database.

In the literature, the two most common measures used to compare profitability are margin ratios and return on capital ratios. *Margin ratios*, which measure the margin of earnings (profit) on gross sales or gross revenue, capture a firm's ability to translate sales dollars into profits; however, they are likely to be related to differences in the capital used in the production process. *Return on capital ratios* measure the returns or profits accruing to assets invested and returns on capital employed (Statistics Canada, 1995). Differences in the return on capital ratios take into account differences in the production process more directly than margin ratios. Using return on capital allows us to look for other explanations for differences in returns between small and large firms than a difference in the production process (or of using different production technologies).

Margin ratios are more appropriate for historical comparisons of the same firm and for comparisons of the performance of different companies engaged in the same business. Moreover, there tends to be more industry-to-industry variation in margin ratios or even across firms, because some firms in an industry may adopt a high-margin, low-volume sales strategy, and others, a low-margin, high-volume strategy that depends on very different capital ratios. In such circumstances, firms of different sizes could generate different margin ratios, but the same return on assets (Baumann and Kaen, 2003). Consequently, return ratios are used in this analysis.[2]

Studies have also differed in their use of before-tax versus after-tax profits, and in including interest payments and depreciation in the estimates. Hall and Weiss (1967) argued that after-tax

2. A more complex multivariate analysis could examine differences in margin ratios taking into account differences in capital intensity. This will be the topic of subsequent work.

profits are more appropriate, because tax rates differ across industries. However, after-tax profits reported in corporation income statements may include items that are not necessarily "income," such as legal settlements and unusual items. In order to focus only on the income generated by the firm, before-tax earnings is the measure used in this study.

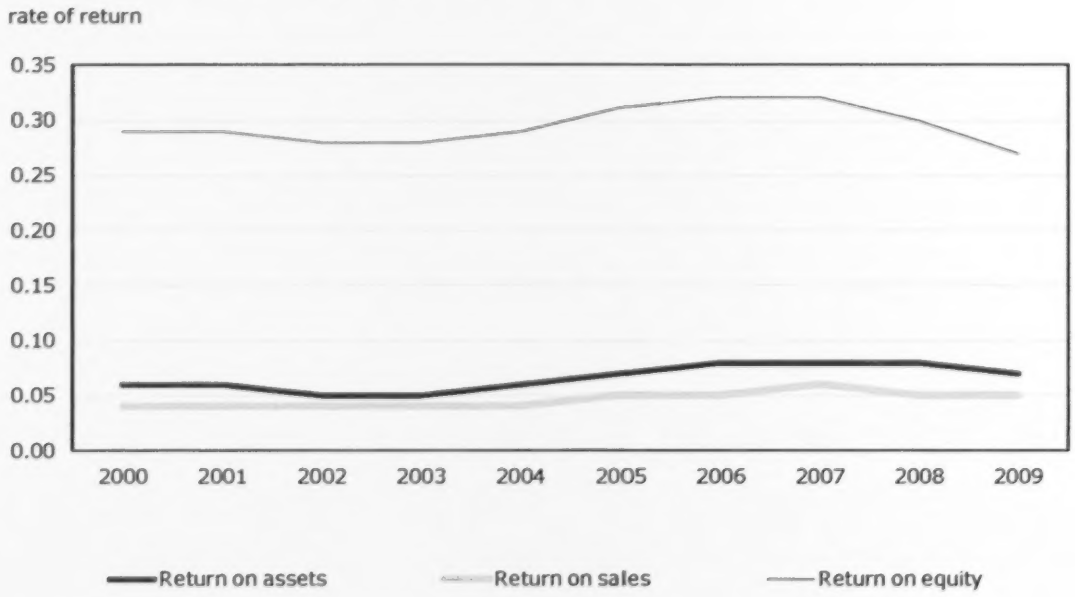
Schmalensee (1989) examined 12 measures of profitability over time and observed similar trends, thereby demonstrating that long-term results tend to be similar regardless of the measure used. Baumann and Kaen (2003) reached the same conclusion when they employed, earnings before interest and taxes (EBIT) margin, earnings before interest, taxes, depreciation and amortization (EBITDA) margin or EBIT to total assets.

This paper uses the most conventional measure of profitability, "return on assets" (ROA), defined as EBIT divided by total assets.[3,4] This measure, also known as "return on investment," captures the efficiency with which a company manages its investment in assets and uses them to generate profits.

Other return ratios that could have been used include "return on sales" (ROS), defined as EBIT divided by sales, and "return on equity" (ROE), defined as EBIT divided by total shareholders' equity. These measures of profitability, estimated over the 2000-to-2009 period, are presented along with return on assets in Chart 1. Return on equity was higher than either return on assets or return on sales, and over most of the period, return on assets was two percentage points higher than return on sales. However, as reported by Schmalensee (1989), the trends in profitability were similar regardless of the return ratio.

Chart 1

Mean profitability rates, 2000 to 2009



Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

3. It is argued (Statistics Canada,1995) that return on capital employed is the best measure of a rate of return for inter-industry comparisons, because all firms in all industries must compete for capital. Information on debt capital is not currently available on T2-LEAP. Instead, the value of existing assets that have been purchased with the capital raised by the firm is used. The two measures will diverge if the value of assets reported deviates from capital raised. Future analysis will focus on the sensitivity of the results to differences in these two measures.
4. Observations in the top and bottom five percent based on return on assets were removed from the sample.

3 Business sector profitability rates

Profitability rates in the business sector rose an average of one percentage point over the post-2000 period (Chart 1)—a period that began in the midst of an economic slowdown and ended during the 2008-2009 global recession. These rates can be disaggregated by industry and province.

Disaggregations by industry indicate the effect of the industry structure on the profitability of firms. Industrial organization theory postulates that profitability is attributable, in part, to environmental factors.[5] Return on assets tends to be higher in industries with fewer product market regulations, fewer barriers to entry, and high capital intensity (Selling and Stickney, 1989). A relationship may also exist between profit rates and sales growth, since the latter may create temporary disequilibrium and higher profit rates.

3.1 Industry dimension

Profitability in 2009 was higher than in 2000 in all business sector industries, except agriculture, forestry, fishing and hunting; mining and oil and gas; manufacturing; and arts, entertainment and recreation (Table 1). Return on assets in the goods and service sectors was almost equal in 2000, but more than one percentage point higher in the service sector by 2009, as a result of that sector's profitability growing by 1.5 percentage points over the period.

5. See Capon, Farley and Hoenig (1996) for a review of the literature on this topic.

Table 1

Mean return on assets, by industry, 2000 to 2009

Industry	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					percent					
Business sector	5.8	5.8	5.5	5.3	6.0	6.9	7.7	7.8	7.5	6.9
Goods sector	5.8	5.7	5.5	5.4	6.2	7.0	7.7	7.8	7.3	5.9
Service sector	5.8	5.8	5.5	5.2	5.9	6.8	7.7	7.8	7.6	7.2
Agriculture, forestry, fishing and hunting	4.4	4.2	4.0	3.2	3.9	3.8	3.8	4.2	3.9	2.0
Mining and oil and gas	9.6	9.1	6.9	8.8	10.3	12.9	12.8	10.5	10.5	6.5
Utilities	4.1	4.9	3.6	4.8	4.7	6.0	6.0	5.7	6.4	4.8
Construction	6.4	6.8	6.6	7.0	7.8	8.8	9.8	10.1	9.5	8.3
Manufacturing	5.5	4.7	4.4	3.8	4.4	4.8	5.4	5.0	4.5	3.5
Wholesale trade	5.2	5.0	4.8	4.7	5.5	5.8	6.2	6.2	5.5	5.4
Retail trade	3.2	3.9	3.8	2.8	3.0	3.6	4.2	4.5	4.6	4.9
Transportation and warehousing	4.5	5.1	4.9	4.9	5.8	6.5	6.8	5.7	5.9	5.0
Information and cultural industries	5.1	4.7	4.6	4.4	4.9	5.7	5.7	6.2	5.8	6.0
Finance and insurance	7.5	6.8	7.1	7.7	8.9	9.4	10.1	10.3	8.9	8.5
Real estate and rental and leasing	5.2	5.3	5.7	5.6	6.0	6.7	7.2	7.2	5.9	5.5
Professional, scientific and technical services	10.8	10.2	9.3	9.1	10.1	11.8	13.1	13.4	13.2	12.0
Management of companies and entreprises	6.5	6.0	5.7	6.2	7.0	8.0	8.8	9.2	8.4	7.8
Administrative and support, waste management and remediation services	7.5	6.6	6.2	6.3	7.3	8.2	8.8	9.0	8.9	8.0
Educational services	5.0	4.7	4.0	3.4	4.3	5.5	6.1	6.3	6.5	7.1
Health care and social assistance	17.6	18.3	17.5	18.1	18.9	20.1	20.8	21.1	20.9	21.3
Arts, entertainment and recreation	4.9	4.7	3.8	3.1	2.9	2.8	3.4	3.5	4.0	4.2
Accomodation and food services	1.5	1.7	1.6	0.3	0.9	1.9	2.9	3.4	3.5	3.5
Other services	4.0	4.1	3.6	3.4	3.8	5.0	6.2	6.1	6.3	5.5

Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

In the goods sector, the most profitable industries were mining, oil and gas, and construction. In mining, oil and gas, the rate of return was particularly high in 2005 and 2006, at more than 12%. Companies in this industry enjoyed relatively high profits throughout the 2000s, in part, because of the resource boom. However, by the end of the period, the rate of return fell to 6.5%, due to the global recession of 2008-2009. The construction industry also experienced a post-2000 boom as a result of the strong housing market and growing demand for new homes. Its rate of return increased from 6.4% to 10% from 2000 to 2007, before falling to 8.3% in 2009.

Industries with lower profit rates than the business sector average were agriculture, forestry, fishing and hunting; utilities; manufacturing; wholesale and retail trade; transportation and warehousing; information and cultural industries; real estate, rental and leasing; educational services; arts, entertainment and recreation; accommodation and food services; and other services. Among this group, sales growth was below average in agriculture, forestry, fishing and hunting; manufacturing; wholesale trade; and information and cultural industries (Table 2).

Table 2
Average annual growth rates in revenue, by industry, 2000 to 2009

Industry	Revenue growth
	percent
Business sector	2.7
Goods sector	2.3
Service sector	3.0
Agriculture, forestry, fishing and hunting	2.6
Mining and oil and gas	6.4
Utilities	6.2
Construction	7.3
Manufacturing	0.3
Wholesale trade	2.3
Retail trade	3.9
Transportation and warehousing	2.9
Information and cultural industries	2.4
Finance and insurance	2.3
Real estate and rental and leasing	4.1
Professional, scientific and technical services	4.1
Management of companies and entreprises	-0.7
Administrative and support, waste management and remediation services	5.9
Educational services	7.5
Health care and social assistance	9.9
Arts, entertainment and recreation	12.0
Accomodation and food services	4.1
Other services	4.0

Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

In the goods sector, the connection between revenue growth and profitability was relatively close—industries with above-average profitability rates had above-average sales growth. From 2000 to 2009, mining, oil and gas and construction saw sales growth two to three times that of the business sector overall.[6] In the service sector, the relationship between profitability and sales growth was weaker. In the most profitable industries—for instance, professional, scientific and technical services, and health care and social assistance—sales growth surpassed that in the business sector overall. However, in other high-revenue-growth industries—educational services, and arts, entertainment and recreation, for example—return on assets was below average and did not increase markedly over the period. The opposite also occurred, with profitable industries (for instance, management of companies and enterprises, and finance and insurance) lagging behind the business sector in sales growth. Thus, the relationship between sales growth and profit rates is stronger in goods-producing, capital-intensive industries.

3.2 Regional dimension

Based on the address of the corporation's head office on the T2 corporate income tax returns, profitability rates were calculated by province. The analysis pertains only to corporations with a head office in Canada; those that reported a head office in the United States or another foreign country were excluded. The Northwest Territories, Yukon and Nunavut were grouped together.

6. If the recession of 2008-2009 is excluded from the calculations, the sales growth in these two industries are more than four times that of the business sector overall.

Table 3

Mean return on assets, by province/territories, 2000 to 2009

Province	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					percent					
Newfoundland and Labrador	2.3	2.6	1.8	1.3	1.0	1.8	2.9	3.9	6.0	6.6
Prince Edward Island	4.6	4.2	4.7	3.5	2.9	3.7	4.5	4.2	4.5	5.5
Nova Scotia	6.8	7.4	7.3	6.6	6.7	6.7	7.2	7.7	8.1	9.0
New Brunswick	3.9	4.2	4.3	3.7	4.0	3.8	4.7	5.3	6.0	6.6
Quebec	7.5	7.8	7.8	7.4	7.7	7.6	7.7	7.6	7.7	7.8
Ontario	5.3	4.6	4.1	3.6	4.0	4.5	5.0	5.4	5.4	5.5
Manitoba	4.4	4.3	4.5	4.4	4.4	5.2	6.4	7.6	8.2	7.6
Saskatchewan	5.1	5.2	5.3	5.3	6.0	8.0	9.6	11.8	12.6	10.6
Alberta	6.9	7.5	6.5	6.7	8.4	11.4	13.0	12.2	11.1	8.4
British Columbia	4.1	4.1	4.3	4.6	5.7	7.0	8.2	8.3	7.3	6.4
Territories	4.1	5.2	5.1	3.9	4.7	5.9	7.1	8.2	8.4	7.9
All	5.8	5.8	5.5	5.2	5.9	6.8	7.6	7.7	7.5	7.0

Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

At the beginning of the period, firms (or head offices) in Quebec had the highest profitability rates, with a 7.5% return on assets (Table 3). The rate remained around this level throughout the period. Firms in most other provinces saw substantial increases in their return on assets, notably, Saskatchewan and Newfoundland and Labrador, where profitability rates rose by 5.5 and 4.4 percentage points, respectively. Firms in Alberta and the Territories also had sizeable increases in their return on assets, bringing their profitability rates to 11.1% and 8.4%, respectively, in 2008. These regions have a large concentration of mining, oil and gas industries, which were highly profitable over most of the period.

At the end of the period, firms with head offices in Prince Edward Island and in Ontario were the least profitable. Return on assets in Prince Edward Island fell below 3% in 2004. This may be due to the large percentage of firms in the farming industry, which tends to be relatively less profitable. Return on assets in Ontario declined over most of the period, reaching a low of 3.6% in 2003, but regained the 2000 level by 2009. This is likely due to manufacturing, which is one of the largest industries in the province, and which suffered during this period as the Canadian exchange rate appreciated, and in 2008-2009 as a result of the global recession.

Average annual growth rates in revenue ranged from 2.3% in Ontario to 6.4% in Saskatchewan (Table 4). There tended to be a weak positive relationship between profitability and sales growth—most provinces with high profitability rates also had high sales growth. The exception was Prince Edward Island, which had slightly higher revenue growth rates than did Ontario and British Columbia, but experienced a drop in return on assets over most of the period.

Table 4

Average annual growth rates in revenue, by province/territories, 2000 to 2009

Province	Revenue growth
	percent
Newfoundland and Labrador	5.9
Prince Edward Island	2.8
Nova Scotia	5.0
New Brunswick	2.5
Quebec	3.0
Ontario	2.3
Manitoba	3.7
Saskatchewan	6.4
Alberta	3.7
British Columbia	2.6
Territories	6.3
All	2.7

Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

4 Profitability and firm size

4.1 Business sector dimension

The previous section has shown variations in profitability rates by industry and province, and a relationship between trends in profit rates and sales growth. The question is whether these patterns hold across firm size classes or are they mainly driven by a particular firm size class.

Firms are grouped into a size class according to their Average Labour Units (ALUs)—estimates of employment based on the firm's payroll, divided by the average hourly earnings of the firm's industry in the Survey of Employment Payroll and Hours. Because a firm's payroll may be less than the industry average hourly earnings, firm size can be "less than 1" ALU. This group includes firms that began operations near the end of the fiscal year, and thus, can contain start-ups.

The most profitable firms were those with an ALU from 5 to less than 20 (Table 5). The return on assets for such firms was just under 7% in 2000 and 8% in 2009. All firm size classes, except the 500-or-more ALU class, saw increases in return on assets during the period, notably, in 2005 and 2006. The largest increase was in firms with an ALU less than 1 or in the 50-to-less than-100-ALU range.

Table 5

Mean return on assets, by firm size class, 2000 to 2009

Size class (Average Labour Units)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
					percent					
Less than 1	4.1	4.0	3.6	3.5	4.2	5.3	6.1	6.2	6.3	5.8
1 to less than 5	6.1	6.1	5.7	5.5	6.1	7.0	7.8	8.0	7.7	7.1
5 to less than 10	6.8	6.8	6.6	6.3	7.1	8.0	8.9	9.0	8.4	7.9
10 to less than 20	6.7	6.9	6.7	6.5	7.3	8.1	8.9	9.2	8.7	8.0
20 to less than 50	6.3	6.3	6.1	5.7	6.6	7.5	8.3	8.4	8.2	7.6
50 to less than 100	5.8	5.7	5.6	5.2	6.3	6.9	7.6	7.7	7.4	7.3
100 to less than 500	5.7	4.7	5.2	5.0	5.7	6.1	6.6	6.7	6.6	6.9
Over 500	5.6	4.7	5.1	4.7	5.7	6.3	6.7	6.2	5.6	4.9
All	5.8	5.8	5.5	5.2	5.9	6.8	7.6	7.7	7.5	7.0

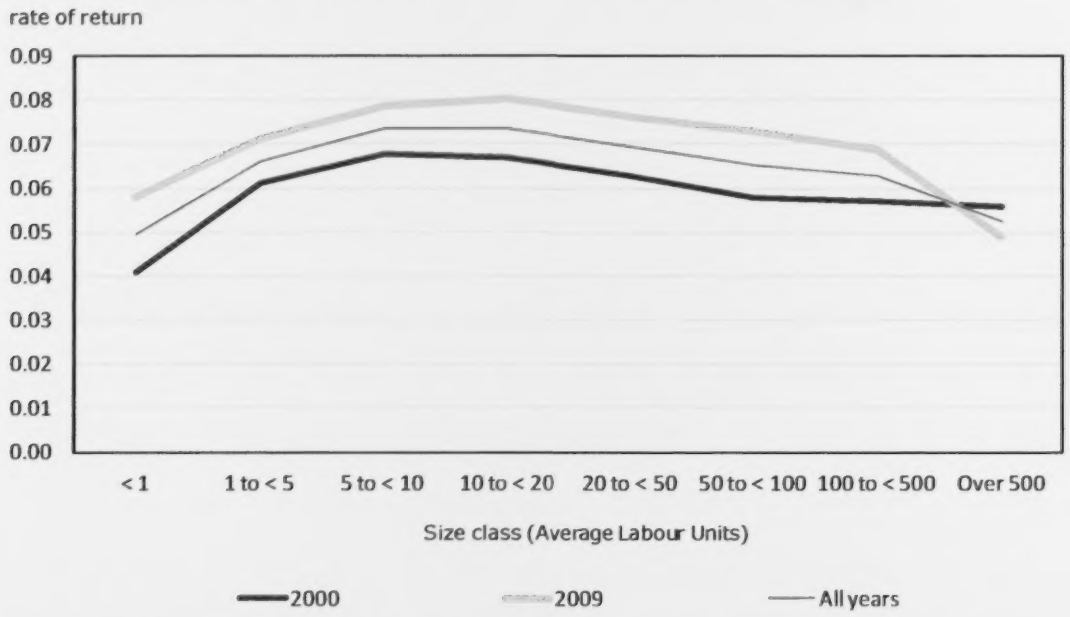
Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

Profitability rates followed an inverted u-shaped curve, increasing with firm size up to a certain threshold and then decreasing, particularly when ALUs surpass 20 (Chart 2).[7] This pattern held over the entire period. In 2009, firms with 500 or more ALUs were the least profitable, with lower rates of return than in 2000. Profit rates in this size class fell steadily since 2006.

7. This trend also holds based on return on equity.

Chart 2

Mean return on assets, by firm size class, 2000, 2009 and all years



Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

The relationship between firm size and profitability is consistent with the theory that the pace at which profit rates rise decreases with firm size. However, firms in the less-than-1-ALU class are very different from those in the 10-to-less-than-20-ALU class. The former, referred to as "micro-firms," tend to be less established. As well, micro-firms are more frequently owner-operated and less likely to use external financing, which they have more difficulty acquiring. Micro-firms may also be less likely to be profit-maximizing, which could help explain their below-average profitability rates.

The results show that the pace at which rates of return rose did, indeed, tend to slow down with firm size, even for very large firms. In fact, the profits rates of the smallest firms resembled those of the largest, particularly toward the end of the period. While this may reflect the impact of the economic downturn on larger firms, the relatively low profit rates of large firms was observed in earlier studies (Samuels and Smyth, 1968). This could be the result of the greater importance of unmeasured intangible capital in larger firms.

Growth rates in sales tended to decrease with firm size (Table 6).[8] At 6.6%, micro-firms had the highest revenue growth, while larger firms generally had below-average revenue growth. The exception was firms in the 100-to-less-than-500-ALU range, which had annual average growth in excess of 4%.

8. This pattern also held when average annual growth rates in revenue were examined excluding 2009, a recession year.

Table 6

Average annual growth rates in revenue, by firm size class, 2000 to 2009

Size class (Average Labour Units)	Revenue growth
	percent
Less than 1	6.6
1 to less than 5	3.9
5 to less than 10	3.5
10 to less than 20	3.8
20 to less than 50	3.3
50 to less than 100	1.5
100 to less than 500	4.1
Over 500	2.3
All	2.7

Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

In summary, the most profitable firms were in the 5-to-less-than-20-ALU range, which is still considered "small." These firms also posted above-average sales growth. They tended to be well established in their respective industries and so had a chance to gain market share over time. Larger firms generally had lower profitability.

4.2 Profitability and firm size, by industry and province

Profitability rates by firm size can be disaggregated by industry and province/territories. This makes it possible to determine if the inverted u-shaped curve tracing the relationship between profitability and firm size holds across industries and regions. Also of interest is whether profitable firms—those in the 5-to-less-than-20-ALU range—are found only in profitable industries. Because the relationship between firm size and profitability prevailed in each year from 2000 to 2009, only data for the end of the period are analyzed.[9]

4.3 Industry

The inverted u-shaped curve characterized most industries in 2009, although return on assets did not peak at the same firm size class in each industry (Table 7). For example, in construction, it peaked at the 20-to-less-than-50-ALU class, but in professional, scientific and technical services, it peaked at the 1-to-less-than-5-ALU class. While the most profitable firms in the goods sector were in the 10-to-less-than-50-ALU class, those in the 5-to-less-than-10-ALU class still had higher return on assets than did larger firms.

9. Similar results were obtained for both industry and firm size when data for 2008 were analyzed rather than 2009.

Table 7
Return on assets, by industry and firm size class, 2009

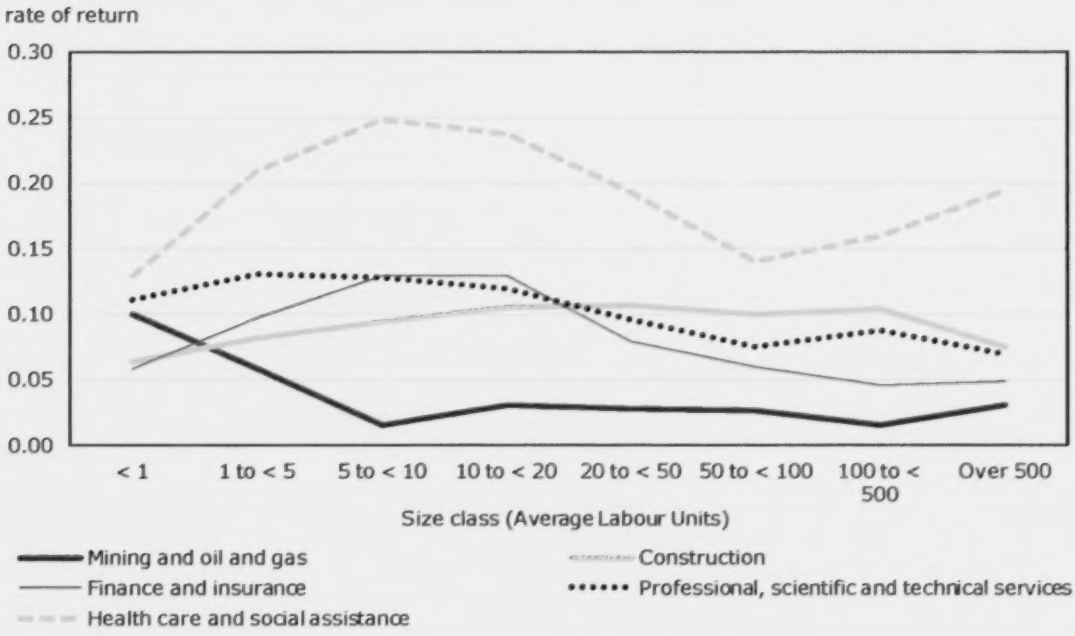
Industry	Class size (Average Labour Units)							
	< 1	1 to < 5	5 to < 10	10 to < 20	20 to < 50	50 to < 100	100 to < 500	Over 500
	percent							
Business sector	5.8	6.9	7.7	8.0	7.6	7.3	6.9	4.9
Goods sector	4.8	5.8	6.6	7.2	7.4	6.3	6.0	4.3
Service sector	6.2	7.3	8.2	8.3	7.7	7.6	7.3	5.2
Agriculture, forestry, fishing and hunting	1.4	2.0	3.0	3.5	3.6	3.5	4.2	5.5
Mining and oil and gas	10.1	5.8	1.6	3.0	2.7	2.6	1.6	3.1
Utilities	5.0	5.1	4.9	1.2	6.6	3.7	5.0	5.1
Construction	6.4	8.1	9.4	10.6	10.7	10.0	10.4	7.6
Manufacturing	1.1	2.9	3.5	4.2	5.1	5.0	5.0	3.5
Wholesale trade	2.7	5.1	6.9	7.3	7.4	6.6	6.6	5.7
Retail trade	0.3	3.6	6.9	8.0	7.6	6.6	7.1	4.0
Transportation and warehousing	4.9	4.8	5.1	5.5	5.6	5.5	5.8	4.0
Information and cultural industries	5.8	6.4	5.1	7.7	6.0	3.5	8.6	4.2
Finance and insurance	5.9	9.7	12.9	12.9	7.9	5.9	4.6	4.9
Real estate and rental and leasing	4.6	5.5	6.8	7.4	7.2	7.3	4.8	5.0
Professional, scientific and technical services	11.1	13.0	12.8	12.0	9.6	7.5	8.7	6.9
Management of companies and enterprises	6.6	9.2	8.1	8.0	7.1	7.0	3.0	5.0
Administrative and support, waste management and remediation services	6.4	7.7	8.4	9.8	11.1	8.9	7.2	6.8
Educational services	7.1	6.9	6.1	10.2	7.8	6.2	7.3	5.8
Health care and social assistance	12.9	21.0	24.8	23.8	19.2	14.0	16.0	19.5
Arts, entertainment and recreation	5.6	4.3	3.5	3.9	2.6	4.1	2.2	3.7
Accommodation and food services	-1.9	0.3	3.8	5.1	6.7	10.9	10.1	5.1
Other services	3.7	5.1	6.7	7.6	9.4	7.1	9.3	3.4

Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

In the five most profitable industries during the period, smaller firms were more profitable than the largest firms (Chart 3). Peak rates of return on assets were in firms with fewer than 50 ALUs. In mining, oil and gas, and professional, scientific and technical services, return on assets decreased with firm size—firms with fewer than 5 ALUs enjoyed return on assets double those of firms with 500 or more ALUs.

Chart 3

Return on assets, by firm size class, five most profitable industries, 2009

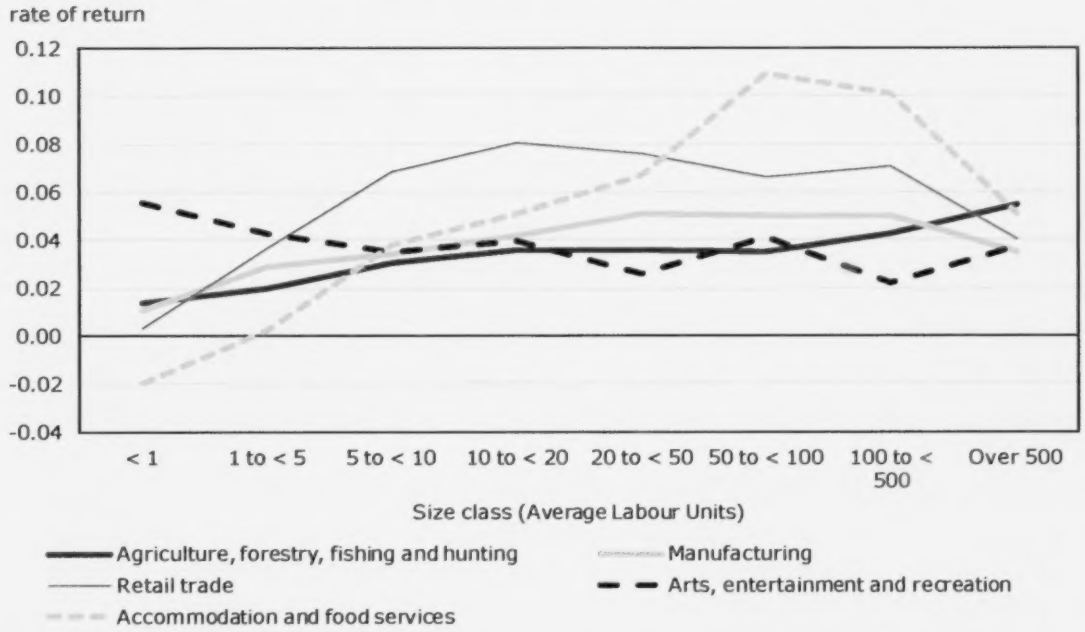


Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

In the least profitable industries, larger firms tended to have a higher return on assets than did smaller firms (Chart 4). And in some industries, return on assets rose with firm size. For instance, in accommodation and food services, return on assets for firms in the 50-to-less-than-100-ALU class was more than 10%, but it was negative for micro-firms. Similarly, in retail trade and manufacturing, the largest firms' profit rates substantially exceeded those of the smallest firms.

Chart 4

Return on assets, by firm size class, five least profitable industries, 2009



Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

4.4 Region

In 2009, smaller firms were most profitable in Alberta and the Territories, while larger firms were most profitable in Newfoundland and Labrador and Manitoba (Table 8). In Saskatchewan, firms had above-average return on assets across all size classes. Micro-firms were least profitable in Newfoundland and Labrador, and Prince Edward Island, where the return on assets was 2.6% and 3.9%, respectively.

Table 8

Return on assets, by province/territories and firm size class, 2009

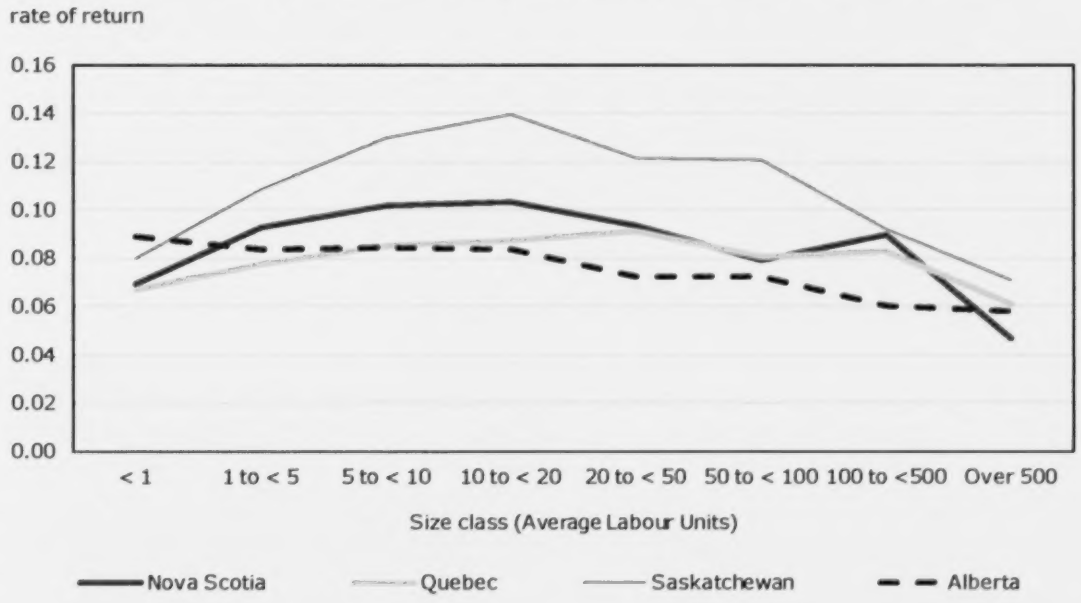
Province	Size class (Average Labour Units)							
	< 1	1 to < 5	5 to < 10	10 to < 20	20 to < 50	50 to < 100	100 to < 500	Over 500
	percent							
Newfoundland and Labrador	2.6	6.7	8.3	9.6	9.4	8.0	7.6	8.6
Prince Edward Island	3.9	5.9	5.3	6.2	5.6	6.5	10.4	4.9
Nova Scotia	6.9	9.3	10.2	10.3	9.3	7.9	9.0	4.7
New Brunswick	4.0	6.5	8.3	7.9	7.8	8.9	8.6	6.4
Quebec	6.7	7.8	8.5	8.8	9.1	8.1	8.3	6.1
Ontario	4.0	5.7	6.7	6.8	6.1	6.0	6.1	3.6
Manitoba	5.4	7.7	8.7	9.3	8.7	8.8	5.9	6.5
Saskatchewan	7.9	10.8	12.9	13.9	12.1	12.0	9.2	7.1
Alberta	8.9	8.4	8.4	8.4	7.2	7.3	6.0	5.8
British Columbia	4.5	7.0	7.6	7.3	7.4	7.6	6.4	4.9
Territories	7.0	7.9	9.7	9.2	6.4	10.5	2.8	4.5
All	5.8	7.1	7.9	8.0	7.6	7.3	6.9	4.9

Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

Diminishing returns with increasing firm size were observed in most provinces in 2009, particularly in provinces where firms had the highest return on assets (Chart 5). Profit rates generally rose up to the 5-to-less-than-20-ALU class (20-to-less-than-50 in Quebec) and then tended to fall with successively larger firm size. In Alberta, return on assets decreased steadily with firm size, which may, in part, reflect the pattern in the mining, oil and gas industry.

Chart 5

Return on assets, by firm size class, four most profitable provinces, 2009



Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

Return on assets tended to be higher in the smaller firm size classes, even in provinces where less profitable firms were prevalent. Across the country, firms in the 5-to-less-than-50-ALU range were the most profitable.

5 Variations in profitability, by firm size

While large firms may have lower return on assets than do smaller firms, their rates of return may be less volatile—that is, lower profitability may be associated with less volatility. This could be because smaller firms assume more risk to attain their higher rates of return. It may also be that smaller firms' production structures are more diverse, and therefore, profitability is more variable across firms. This may occur if a large percentage of small firms are younger firms in the early stages of operation, which involves experimentation with new products. By contrast, larger firms are older and have homogeneous production technologies that focus more on economies of scale.

Earlier studies have reported that the variability of profit rates is inversely related to firm size (Stekler, 1964; Samuels and Smyth, 1968; Ballantine et al., 1993). In other words, the range in profit rates is much greater among small firms.

Variations in this paper are first measured within a firm size class, by using the coefficient of variation (CV). This is calculated as the variance in return on assets of different firms within a size class, divided by the mean return on assets of firms in that size class. The CV is often used as a measure of risk, because it is a normalized measure of dispersion of a probability distribution.

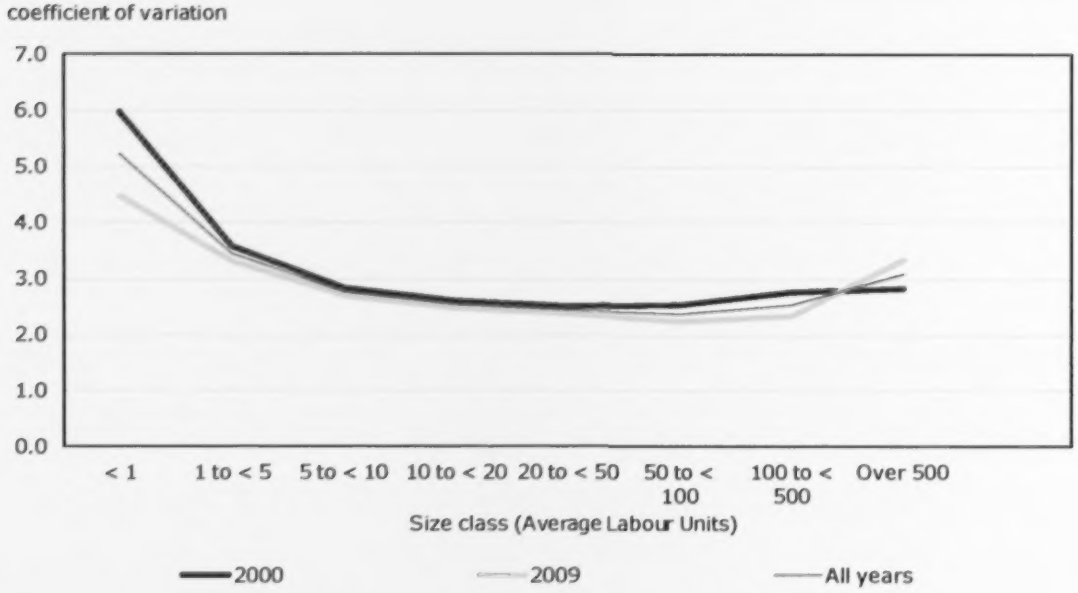
The coefficient of variation of profit rates of firms within a size class ranged between 2.4% and 5.4% over the period (Chart 6). In 2000 and 2009, the smallest firms (ALU less than 1) had the highest CV. The diversity of profit rates among firms in a particular size class was inversely correlated with size for smaller firms. The CV curve decreased with firm size until the 20-to-less-than-50-ALU group, which is also the range in which firms were most profitable. It then increases slightly for the largest size classes. Nevertheless, the smallest firms take on the most risk.

Second, variability of profit rates is examined over time across firms. The year-to-year standard deviation in return on assets of continuing firms during the 2000-to-2009 period is estimated and averaged across time and firm size classes based on size in 2009.[10] Measuring variability in profit rates over time tests for the sensitivity of each size class' ratios to time-specific events such as business cycles which may result in higher profit rates in some years than in others.

10. Among continuers, approximately 47% of firms switched size class from 2000 to 2009. The standard deviations were recalculated using the 2000 size class, but no significant difference was apparent between the averages obtained in 2009 and those obtained in 2000.

Chart 6

Coefficient of variation of return on assets within a firm size class, 2000, 2009 and all years



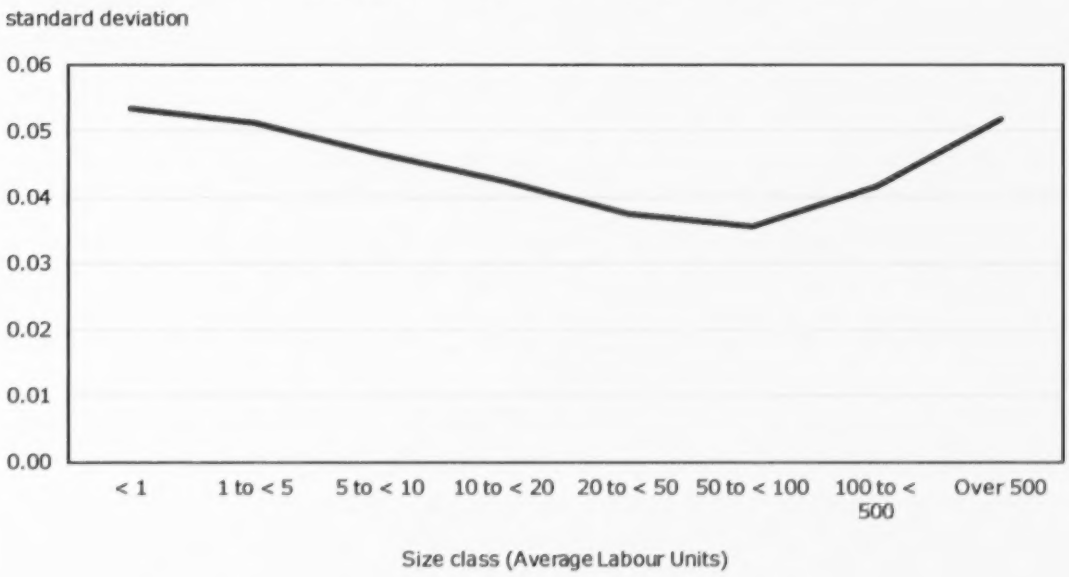
Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

Variability of profit rates over time across firms may differ from variability in profitability within a size class. To investigate this, only firms that reported profits in all years over the 2000-to-2009 period are examined. The year-to-year standard deviation in return on assets of a given continuing firm during the entire period is estimated and averaged across time and then by firm size class based on the ALU in 2009.

Micro-firms and firms in the 1-to-less-than-5 ALU range experienced the most variation over time in profitability, with a standard deviation of just over 5% on average (Chart 7). The time variability in profitability by size class followed a u-shaped curve, which is close to the inverse of profit rates across size classes. Firms with the least variation in their return on assets were in the 50-to-less-than-100-ALU group, which is larger than the size class with the highest profitability rates. However, the difference in variability between firms in this size class and in the 10-to-less-than-20 ALU range was less than one percentage point.

Chart 7

Standard deviation of yearly return on assets, by firm size class



Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

Our finding that the intra-group variability of profit rates tends to be inversely related to firm size is consistent with previous studies (Stekler 1964, and Samuels and Smyth 1968). The large difference between the CV of return on assets for micro-firms and that of much larger firms indicates that as firms grow, their rates of return on assets become more similar to those of other firms in the same size class. Micro-firms and slightly larger firms are the most heterogeneous group. As mentioned above, these firms may have a more diverse set of goals, ranging from profit-maximizing to job and career satisfaction.

The variability of profit rates over time also follows a u-shaped curve, in that it is inversely related to firm size up to the 50-to-less-than-100-ALU class. The largest firms experienced as much volatility in their return on assets as did micro-firms, while "medium" firms had more stable rates of return. However, the difference in volatility over time across size classes is much smaller than the intra-group volatility.

6 Conclusion

Studies of small, medium and large businesses in Canada have extensively investigated differences in job growth, entrepreneurship, and access to financing. The relationship between firm size and financial performance has been largely ignored.

This analysis finds that, during the 2000-to-2009 period, the relationship between firm size and profitability, as measured by the rate of return on assets, followed an inverted u-shaped curve. Specifically, return on assets increased up to a small firm size class (10 to less than 20 ALUs) and fell at larger firm sizes. This pattern prevailed throughout the post-2000 period, consistent with the results of other studies that reported diminishing profitability with increasing firm size—at least beyond a threshold that excludes micro-firms.

This relationship between firm size and profitability was observed in most industries and provinces, particularly those with the highest profitability rates.

The intra-group variation of profitability is inversely related to firm size, as measured by the coefficient of variation. Smaller firms tend to have much more variation in profit rates as well as higher rates of return. These results provide evidence that as small firms grow, their financial performance becomes more homogeneous.

The intertemporal variability of profit rates of individual continuing firms over the post-2000 period followed a u-shaped curve. Beyond the smaller size classes, firms' intertemporal variability in profit rates decreased in the middle size classes but then increased in the largest groups during this period. However, the difference in the inter-year variability in return on assets across size classes was much smaller than the intra-group variability, which may be the result of the decade examined.

7 Appendix

7.1 Data source

The T2-LEAP database was created by linking two administrative databases: the Longitudinal Employment Analysis Program (LEAP) and the Corporate Tax Statistical Universal File (T2SUF). LEAP includes all employers in Canada (incorporated and unincorporated) that register a payroll deduction account with the Canada Revenue Agency (CRA). The database was originally designed to provide longitudinal data on the behaviour of employment levels of Canadian businesses (Baldwin et al., 1992). The T2SUF database includes all incorporated firms that filed a T2 tax return with the CRA and provides data on sales, gross profits, equity, and assets.

The LEAP combines data from three major sources: the administrative T4 data from the Canada Revenue Agency (CRA), information from Statistics Canada's Central Frame Database or Business Register, and the Survey of Employment, Payrolls and Hours (SEPH). In linking the BN payroll account-province observations from the T4 administrative files to statistical enterprises in the Business Registry, the LEAP becomes a longitudinal file of enterprises with information on the payroll at the national and provincial levels. Information from the SEPH is used to calculate a measure of employment for each enterprise—an Average Labour Unit (ALU). An ALU is the average employment an enterprise would have if it paid its workers the average annual earnings (AAE) of a typical worker in the enterprise's 4-digit industry, province and enterprise size class, where AAE are derived using information from the SEPH.[11]

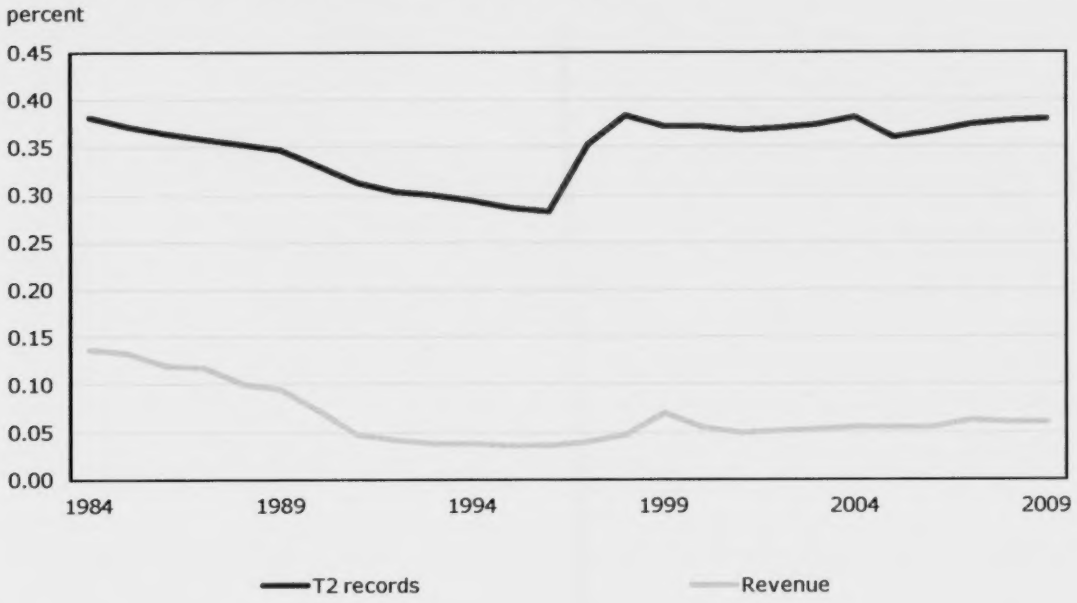
Because employment data in the LEAP file are reported on a calendar-year basis and the year of attribution on the T2 files is set at the end of a fiscal period, the values of financial variables in the T2 files are converted to calendar-year terms in T2-LEAP.

Linkage between the LEAP and T2 files does not result in a universe of incorporated enterprises; a percentage of records is not matched (Chart 8). Post-2000, approximately 37% of T2 records could not be matched to a LEAP record. However, despite the low match rate, the fraction of revenue accounted for by unmatched records averages only 6%.

11. More information on the derivation of ALU is available in Lafrance and Leung (2009).

Chart 8

Fraction of T2 records and revenue from T2 records that cannot be matched to Longitudinal Employment Analysis Program



Note: T2 – Income tax return.
Source: Statistics Canada, Longitudinal Employment Analysis Program; and Canada Revenue Agency, Corporate Tax Statistical Universal File.

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